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VOLUME XLVI, 1935

JOHN MERTON ALDRICH;
1866-1934.

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JANUARY, 1935

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Communications on observations made in the course of your studies are solicited; also exhibits of any specimens you consider of interest.

The printer of the "News" will furnish reprints of articles without covers over and above the twenty-five given free at the following rates: One or two pages, twenty-five copies, 35 cents; three or four pages, twenty-five copies, 70 cents; five to eight pages, twenty-five copies, $1.40; nine to twelve pages, twenty-five copies, $2.00; each half-tone plate, twenty-five copies, 30 cents; each plate of line cuts, twenty-five copies, 25 cents; greater numbers of copies will be at the corresponding multiples of these rates. Printed covers for 50 copies, $4.00 or more, according to number of pages bound.

Yours sincerely
S. Williamson.

ENTOMOLOGICAL NEWS

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Edward Bruce Williamson.

(Portrait, Plate I.)

Edward Bruce Williamson, diligent and thoughtful as collector, student and author in advancing our knowledge of the Odonata, died at Ann Arbor, Michigan, on February 28, 1933, as announced in the NEWS for March of that year. He was a frequent and welcome contributor to our pages during a period of thirty-four years; of his 103 papers and notes on insects, 57 were published here. Prof. Frederick M. Gaige, Director of the Museum of Zoology, University of Michigan, writes that the NEWS was the journal Williamson most enjoyed. It is, therefore, appropriate that a somewhat extended biographical notice should appear in our columns. That which follows avoids, as far as possible, repetition of the accounts of his life which Prof. Gaige and Prof. J. J. Davis have respectively published in the Annual Report of the Director of that Museum for 1932-33 and in the Proceedings of the Indiana Academy of Science, volume 43, each accompanied by the same portrait but different from that in our present number.

His father, Lent A. Williamson, was born in Fairfield County, Ohio, December 8, 1845. His mother, Dorothea Kellerman, a native of an adjoining county (Pickaway), of the same state, was born at Ashville, January 24, 1849. The parents went to Indiana and at Marion, in Grant County, their first child, Edward Bruce Williamson, was born July 10, 1877. In 1879, the family moved to Bluffton, thirty miles to the northeast, and here their life was centered for fifty years. The father engaged in the hardware business with his brother, George T. Williamson, and later became president of the Wells County Bank in that town until his death, on December 21,

1914, in California.* Of him, Bruce wrote, January 2, 1915: "We both loved collecting [dragonflies] and he took a sincere interest in my work." A maternal uncle, William Ashbrook Kellerman (1850-1908), was Professor of Botany at the Ohio State University, at Columbus, from 1891 to 1908. Bruce's mother died at Bluffton, October 8, 1928.

Bruce attended the Bluffton Public Grade and High Schools and in 1894 entered the Ohio State University. In a supplementary certificate, applying for a position as Assistant Biologist, which he filled out in November, 1900, under United States Civil Service Commission rules, he wrote of himself:

"I was a student at Ohio State University, Columbus, Ohio, for four years, receiving the degree of Bachelor of Science, June 16, 1898. For graduation usual college courses in zoology, botany, geology, mineralogy, chemistry, physics and astronomy, as well as courses in English, political economy, logic and one modern language were required. Four years of Latin was one of the requirements for entrance to this course. In my senior year I took beginning Greek. As elective work I took advanced courses in invertebrate palaeontology, petrography, systematic botany (grasses and sedges), food analysis in chemistry, human histology, vertebrate anatomy, invertebrate anatomy, vertebrate embryology and vertebrate neurology. All of these were laboratory courses, running through the college year, and six or ten hours per week were given to each subject. During my college course I was at different times secretary of the Biological Club and president of the Wheaton Ornithological Club. My thesis, with Mr. [later Professor] R. C. Osburn, was a descriptive list of the fishes of Franklin County, Ohio, together with secondary lists of the Astacidae, Amphibia and Reptilia."

Prof. David Simons Kellicott (1842-1898), was Professor of Zoology and Entomology at Columbus from 1888 to 1898 and, at the time of his death, shortly before Williamson's graduation there, general secretary of the American Association for

* An extended obituary notice of Lent A. Williamson is in *The Evening News*, of Bluffton, for December 26, 1914. Other issues of the same newspaper contain accounts of E. B. Williamson's expedition to Barbadoes, Guiana and Trinidad (March 21, 1912), Panama and Colombia (March 15, 1917) and Venezuela (May 15, 1920), with many personal details.

the Advancement of Science. His field studies on the Odonata of Ohio, published in the Journal of the Cincinnati Society of Natural History (1895-1897) and by the Ohio Academy of Science in 1899, doubtless contributed to Williamson's interest in these insects if they did not originate it. In September, 1898, Williamson wrote to me: "For the past three summers I have been collecting dragonflies whenever time permitted, about my home in northern Indiana. Sixty-one or sixty-two species have been taken." This fixes the beginning of his odonatological activity as not later than 1896.

The year of his graduation from Ohio State, 1898, was also the year of his first appearance as an author, as may be seen from the bibliography accompanying Prof. Gaige's biography. Alone, or in association with R. C. Osburn, he published on fishes, crayfish, birds and dragonflies.

About the end of July, or the beginning of August, 1898, he entered the Carnegie Museum, at Pittsburgh, Pennsylvania, as assistant curator of insects.

Returning to Philadelphia on August 29, 1898, from a brief collecting trip into New Jersey, bringing with me specimens recognized as an undescribed species of *Ischnura,* I found Williamson's first entomological paper awaiting me—three pages on "September Dragonflies of Round and Shriner Lakes Whitley County, Indiana," from the Report of the State Geologist of Indiana for 1897. It contained a footnote by Prof. Kellicott briefly describing a single female referred to "Enallagma sp (?)". The description seemed to correspond to some of my *Ischnurae* from New Jersey. I wrote to Williamson about it, in the first week in September. He replied on September 9, 1898. The rest of the story may be found in the NEWS for November, 1898.

So began a correspondence, for me the most extensive carried on with any one person and only terminated when my reply of February 20, 1933, to his of February 6 arrived too late to find him conscious. There are 527 of his letters lying before me, 57 of them six or more pages in length, chiefly concerned with the Odonata, but here and there touching on other

phases of his very active life. To no one in this field of entomology do I owe more than, or as much as, to these letters of Williamson. Both of us had a great interest in the tropical American Odonate fauna and each turned to the other for advice, suggestions and sympathy. We met but once, when I stayed at his home in Bluffton from December 28 to 30, 1912. We were thus compelled to rely upon letters and publications for the comparison of our ideas. Looking backward, one can appreciate the amount of time which our mutual correspondence alone involved, and must realize that the survivor feels a very great loss in his world. Williamson was younger than I and in the natural course of events he might have been expected to perform this present office for me, rather than that I should be commemorating his deeds after his passing.

From July 16 to August 15, 1899, Williamson was one of a party led by Dr. W. J. Holland, Director of the Carnegie Museum, which collected chiefly vertebrates in Wyoming. In a letter written the day after his return to Pittsburgh he says:

"I have been thinking a great deal about going to the U[niversity] of P[ennsylvania] to take a course in medicine," and again on September 29: "I was arranging my affairs to spend this winter at Philadelphia in the medical department of the U. of P., but after my resignation at the Museum I was offered the position of teacher of science in the high school here [Salem, Ohio], so I have taken the position for the year. Next year I hope to be able to enter the U. of P. and complete the medical course in three years." On January 24, 1900, he wrote: "In spite of plans and wishes, which have never availed anything, I guess, it will be impossible for me to take a course in medicine at U. of P. I am rapidly losing my hearing, due to a catarrhal affection of the middle ear." . . . "about my hearing —I am afraid nothing can be done. The trouble is I think congenital and it has been aggravated by exposure."

In the first days of July, 1900, he had a week's collecting at Ohio Pyle, on the Youghiogheny River, in Fayette County, Pennsylvania "and caught enough *Calopteryx angustipennis* to supply the world—have 132 good specimens besides some damaged ones." No other male of this species was then known to

exist than that in the British Museum, sent by John Abbot, from Georgia, a century previously. Doubtless the world of his correspondents received them, for he was always most generous in sharing his material with others. His letters of this year refer to much correspondence with the late James S. Hine at Columbus, and with Charles C. Adams. His first mention of C. H. Kennedy, now Professor at Columbus, is in connection with a trip to Winona Lake, Indiana, in July, 1900, and about the same time he appears to have begun correspondence with Prof. James G. Needham.

In the summer of 1901 he was at the Winona Lake Laboratory of Indiana University and again at Salem, Ohio, in the Fall until the Christmas holidays.

Many of his letters of 1902 are on paper bearing the printed letter heads of the Wells County Bank at Bluffton, with his father's name as President, and he probably began to work there in January of this year, but his name does not appear in the list of officers thereof until a letter of March, 1903, when he is given as Assistant Cashier.

On April 16, 1902, he married Miss Anna Tribolet. She and three adopted daughters survive him.

On October 19, 1904, he wrote:

"I suppose there would be no chance at M[useum] C[omparative] Z[oology] for a permanent curatorship? I am pretty well situated now as far as leisure time goes but I am always on the lookout for anything which will give me greater opportunity to work on dragonflies."

In his letter of September 20, 1904 (15 pages) he discussed questions of nomenclature at length, concluding:

"I am in favor of giving a binomial name (and a binomial only) to every form which can be defined to cover a considerable number of individuals, which individuals or similar ones it is to be expected other students may in time collect and study." This position he maintained to the end of his life.

On December 31, 1904, Mrs. Williamson, he and four others, left Buffton on a collecting trip to Guatemala for Odonata and returned March 8, 1905. He published an Itinerary of this

expedition in the NEWS for November, 1905. Two days after his return, he wrote:

"I think my dragonflies will enable you to formulate some such law as this: The species occurring at any locality during the dry season are those species of widest distribution. Or, in other words, local species are to be found at the height of the season. . . . From February 10 to 24, inclusive, I was practically shelved as a result of an attack of tropical fever contracted at San José on the Pacific."

He made a second expedition to Guatemala in May and June, 1909,* and it is probably to this trip that a passage in a letter of July 13, 1910, refers:

"I never made any pretensions at care of my health in Guatemala after the first few days down there. I was especially careless about food and drink and I never found the native cooking palatable."

On his return from Guatemala in 1905 he was offered the cashiership of the bank at Bluffton.

"To refuse it seems to me to invite business ruin and loss of associates' respect. To accept means still less energy and time for Odonata, but possibly opportunities for greater leisure in future years. I have worked at business and at dragonflies, hoping someday to be in a position to have independent income sufficient to enable me to take some position in a museum at a small salary but with large leisure for pure science work along lines I might select." (March 10, 1905.)

He accepted and the aim thus set was actually realized, although banking failed to afford him the means which, in 1905, he was justified in expecting.

His letter of May 15, 1906, says:

"Recently put the bird egg collection belonging to brother and myself in City Library. City furnished a light and dust proof case which makes the eggs accessible, however, even to little tots. We found we had 93 species and about 1200 eggs, nearly all local. Of red-shouldered hawks, 13 sets, 33 eggs, all collected by myself—hawks are rare with us."

* Collecting records of this expedition are cited in Ris's Libellulinen, Cat. Coll. Zool. Selys, and in Williamson's own papers, Occas. Papers No. 130 and Misc. Publ. No. 9, both of the Univ. Mich., Mus. Zool., 1923.

His interest in birds' eggs, both before and after this gift is evidenced by some passages in his letters:

"The evening before my marriage I climbed 70 feet in one of the biggest oaks in an hundred acre woods for a set of 3 of red-shouldered hawks eggs and two days after my marriage I took another set of 2 of the same species." (April 28, 1902.)

"An M.D. diagnosed my liver trouble as pleurisy. He said calomel was alright if I had been doctoring the right organ. He prescribed salicylate of soda and quiet. I took the medicine alright (90 grains a day for a week) and climbed 80 feet up a big sycamore for a hawk's nest, since which my recovery has been rapid and complete." (April 28, 1908.)

In April, 1916, he had a corneal ulcer of which he wrote:

"I carried my eye in a sling 10 days though and had to climb for a set of great horned owls with the eye bandaged and with a strip of ice and snow a foot wide up the tree from the ground to above the nest which was 55 feet high."

Another interest had developed:

"I have a nice lot of iris blooming in my garden and I have been spending some time since my return cross-pollinating. If weevils don't destroy all the seed, I ought to have a pretty thorough mix-up. Next to orchids which are undoubtedly the finest flowers, fad or no fad, I prefer Iris." (June 11, 1907.)

In 1910 he hoped that the American Museum of Natural History could be interested in purchasing the René Martin Collection of Odonata.

"If I could get in such an institution with Martin's Collection and my own as a foundation to build on and work with, I might eventually evolve to a point where I could be of some real assistance in this dragonfly work. I am 33 years old (last Sunday, when I worked 21 hours) and I come of long-lived stock. In the next 30 years I could do lots of work if I had a chance."

He raised the question as to the American Museum again in a letter of July 11, 1914.

In December 1910 he wrote that he had ordered a motorcycle "and next summer I'm going after the local stuff as I never did before." In the following July he reported

"Four weeks ago I tumbled for the fifth time from my motor-cycle . . . and damaged one arm, both legs and made a climax by breaking a rib. So I didn't ride any more till July 2."

"During the warmer months, I spend all my Sundays and holidays (3 or 4) in the woods or fields, always collecting or bluffing at it. I might stay at home and work material these days, but I am so confined during the week, I naturally break for the woods with my lunch in my pocket Sunday. On these days I want to be absolutely alone, or with some one who doesn't talk at all. The only religious sense I have is a feeling of absolute oneness with the visible world—whatever of mortality or immortality, of chance or design belong to the woodland swamp, to the blue iris and to the red-winged blackbirds and to the fox squirrels belong to me to an identical degree. So I want one day of the week to think it uninterruptedly. And collecting (the way I collect on Sundays) doesn't interfere." (June 14, 1912.)

"I enjoy collecting better than anything else and everything else in the world. If my objective mind stops business for a minute, the subjective jumps right in with palm forests, blue, hazy, verdure-covered mountains, little gravelly brooks, muddy lagoons—and me and a bug net. So why worry about unworked material." (March 23, 1919.)

But even in summer other thoughts arose:

"This summer I am going to write a scathing letter to the Editor of *Science* relative to the scientific (natural [science]) men of this country who annually flock to the seashore (where biological conditions are practically eternal) or to the largest freshwater lakes they can reach (where biological conditions in permanence compare favorably with 'the eternal hills') while all over this country unique biological conditions are being destroyed never to be replaced or duplicated. I have in mind just now Vanneman's swamp. (Above is half joke and half dead earnest. Really when I see that swamp going I can almost cry.)" (July 29, 1913.)

A hope which he never realized but which he entertained until the day of his death was a monograph of the genus *Argia*.

"It really 'grinds' me that my life is slipping away and I can get so little done myself. I have things in such good shape if I had only more leisure." (Oct. 8, 1913.)

"It is more and more evident that if I am to get any dragonfly work done, I shall have to get out of the bank; but I do not see the way. And I have things in good shape to work, too, if I could only find a little more time and strength. The little I have done has been only by the most rigorous application and self-denial in every other line." (Jan. 2, 1915.)

In 1915 he wrote to Ris to learn if Menger, the artist at the Brussels Museum, could make drawings of *Argia*.

"I want to get material together so . . . can do an Argia paper some day. I don't know but I believe I have at least 2000 unstudied specimens here." Menger did make the drawings and they are at Ann Arbor.

"And some day some student of Argia will rise up and call me blessed! . . . And I may fool the doctors and live to study my Argias myself. Anyway I had the joys of several existences in catching them." (May 1, 1919.)

His health fluctuated greatly in 1915 and 1916.

"My hilarious and ungrateful amoebae, not satisfied with free board and lodging, set up some rectal trouble for which I am taking treatment here [Grand Rapids, Mich.]." (Nov. 19, 1915.) He returned to Bluffton the first week of December. "I came away from Grand Rapids feeling fine." "Have been out of the bank about half the time the last week or ten days—sick with some obscure intestinal trouble." (Jan. 13, 1916.)

"The doctor here thinks I have an ulcer or ulcers in the duodenum. At times the attacks are very severe, fairly taking all the nerve I have and leaving me feeling weak and bruised for a day or two afterwards. Monday and Tuesday were bad days, finally requiring opiates and hot external treatment—it got me to where I was whimpering. (Jan. 15, 1916.)

"My health is perfect." (Jan. 29, 1916.)

"My gizzard turned me on my head last Thursday. It had been good for several weeks. . . . However, for about 45 minutes I heard the choir invisible. It's great sport." (March 4, 1916.)

"I feel better this spring than I have for several years and I think my amoebae are dead and my intestines healing at last." (April 11, 1916.)

In late November, 1916, he started for Colombia where he and his cousin Jesse H. Williamson collected until March 12th.

On the return trip down the Magdalena he wrote: "We have 150 species of dragonflies and 8543 specimens in papers." Among the localities visited in Colombia was

"Cristalina the best collecting spot I ever saw in my life—it was (or is) simply wonderful. It would make a beetle man dissatisfied with heaven. In fact I much prefer Cristalina myself, from various reports I've heard."

This expedition was in part financed by the Museum of Zoology of the University of Michigan and so began the connection which later resulted in Williamson's becoming Research Associate there.

In November, 1917, he underwent an operation, and four and a half weeks later had an attack of pneumonia which

"kept me flat for four weeks. . . . Now that I'm up and about again I'm about the gentlest and tamest unconverted bug hunter in captivity." (Jan. 15, 1918.)

"I was looking again to-day at the little Fundacion freak [*Agriogomphus hamatus* Wllms.] . . . I think I'd better get it out and prepare a little paper and some drawings. When I thought I was going to die, when I had pneumonia, the thoughts of it and a fine lot of *Macrothemis* we got in Colombia more than anything else made dying distasteful." (Jan. 21, 1918.)

In 1918 he was elected President and a director of the Wells County Bank at Bluffton, of which he had been cashier since 1905. In 1918 also he was President of the Indiana Academy of Science.

There is a gap in his letters between March 18, 1925, and February 27, 1926, on which latter date he writes:

"I am just beginning to perk up a bit after having lost one year. . . . I am most anxious to get 3 started papers completed and then get at *Gomphoides* as I have borrowed material of that genus."

His cousin, Jesse H. Williamson, son of George T. Williamson, his father's brother, wrote on July 9, 1927:

"Bruce is in better physical condition than at any time during the past three years. He resumed active duty in the bank just a year ago and has been on the job there practically every day since. Bank duties and problems have been particularly

difficult and trying for the past two years in our little community, as the largest bank here was in a failing condition and finally closed its doors a few months ago. While its closing did not put an end to all problems by any means, it did relieve the suspense which is very trying to the nerves of a thyroid patient. Business conditions have added greatly to Bruce's burdens and required much time that in former years would have been devoted to Odonata. The iris culture has developed from a back-yard proposition to a real business requiring lots of time, energy and correspondence particularly for several months each spring. Bruce has not the strength and endurance required to carry on banking, iris business and scientific work simultaneously, as in days gone by and hence the last has had to be neglected . . . his failure to answer welcome letters has been due to the fact that he feels that *all* his energy should be devoted to his business connections in place of using even a part in riding his hobby. If he had his former strength he would still be burning the mid-night oil in the "bug room" long after a full day's work at the bank had been done. We hope that conditions will change so that he can again spend time working on Odonata without feeling that he is thereby depriving his business associates of any energy that should be devoted to business matters."

In 1928, his bank at Bluffton closed.

On November 8, 1928, E. B. wrote:

"All my dragonfly work this past season has consisted of every Sunday trips to points in northern Indiana, data (insignificant) turned over to [B. E.] Montgomery to whom I willed the Ind[iana] dr[agon] fl[ie]s. For several years it has seemed to me that the northern Ind. Aeshna fauna was not what it used to be and I spent Sundays and some other days looking diligently in many localities for them. And they 'ain't' here. Saw 2 spp.—one a pair Montgomery caught—and a few *Ae. umbrosa*—and nothing else. And we visited dozens of lakes, completely encircling several, marshes, back-ups, cut-offs and every kind of habitat we would find."

On June 22, 1929, in answer to an inquiry he replied:

"Yes, I still have my dragonflies, library and iris and the last largely explains my delinquencies as a letter writer. For I've been very busy therewith and have never felt better in my life. . . . We have all of us been working with the iris and we've been busy too. Lots of visitors from all over, endless

correspondence, more field work than we can do, and unfilled orders always staring us in the face. . . . I have no definite future plans. If it is at all possible I hope to spend the rest of my life working with dragonflies and iris and nothing else. If I have to come to one thing it will be dragonflies, as I find they can pull me away from the iris—a thing I believe nothing else could do. . . . The iris business is making a little but not quite a living."

The realization of his hopes was expressed in his letter of August 16, 1929:

"Dr. Gaige . . . came to tell me they have made a position of research student of Odonata there [Museum of Zoology, University of Michigan] for me. The only thing is that I must be in residence 3-4 months a year—otherwise I select my own problems, my own methods and do pretty much as I please, with no students unless I want them—which I do—I need about 4 right now. I shall store my collection at Ann Arbor. They have given me two of the large offices in the new building with all the additional storage space I need. It is just simply an ideal layout."

"I am moving my collection and library to Ann Arbor." (Oct. 8, 1929.)

"The past two weeks have been very busy ones but about the happiest I've ever known. I have every facility and all the room one could wish for." (Dec. 21, 1929.)

"I've had a delightful winter here and got done about ¼ what I thought I could if I were free to do as I pleased as I have been here." (Mar. 31, 1930.)

Many another extract from his correspondence, of interest to the student of the Odonata, must be omitted, but we shall at least quote from his last letter to me—that of February 6, 1933—

"Thanks for your note on *Cal[opteryx] dimidiata* and *apicalis,* which as I interpret it, is an apology for following Hagen, who led you astray in your callow youth into positions which you now recognize as untenable. Signs of age grow on me; one of the most deplorable is my lack of ability to come back at you with a hot retort for your 'Great Williamson' slam. 'Plumed Leader' is hardly the term I need, so in my senility, you escape a rejoinder you so richly deserve."

Of the 102 papers on Odonata listed in Prof. Gaige's bibliography of Williamson, 11 deal with the Odonata of Indiana, 6 with those of Pennsylvania, 36 with those of other parts of the United States or are monographs of genera (*Stylurus* 1901, *Macromia* 1909, *Celithemis* 1922), restricted to United States species, 6 are concerned with those of Canada, 28 with those of the neotropical fauna and 3 with those of other parts of the world (Formosa, Burma and Siam). The remainder describe habits or give directions for collecting and preserving dragonflies and one (1913) is purely morphological. In number of pages his publications on the neotropical fauna exceed those of any of the other groups enumerated, and include monographs of the genera *Protoneura* (1915), *Neoneura* (1917), *Heteragrion* (1919), *Triacanthagyna* and *Gynacantha* (1923) *Erythemis* (1923) and *Perilestes* (1924), as well as descriptions of new genera and species. A list of all the new genera (14) and species (92) which Williamson described accompanies Prof. Gaige's biography. Four of his papers propose rearrangements of larger taxonomic units, the Oriental Calopteryginae (1904) and Gomphinae (1907) and the Cordulinae (1908) and Gomphinae (1920) in general. Among his observations on habits of the Odonata, the most remarkable was his discovery of the exact positions assumed by the abdominal appendages of the males in relation to the females at copulation (1899, 1906), correcting previous statements on this subject.

That which especially distinguished E. B. Williamson, it seems to me, was the combination of indefatigability as a collector, and minuteness of observation and of discrimination as a student and author. This resulted in his knowing the Odonata, both in the field and in the laboratory, with probably a greater thoroughness than any of his predecessors or contemporaries. These qualities are especially displayed in his *Notes on American Species of Triacanthagyna and Gynacantha* of 1923, which I am inclined to regard as his greatest work, though the *Notes on species of the genus Heteragrion Selys* (1919) stands not far behind. "Great Williamson" was not a mere playful jest in correspondence, but indicates the position he won in his field of entomology. P. P. CALVERT.

The photograph from which Plate I was made was taken about 1922, the autograph is from a letter of July 1, 1929.

An Analysis of the Cicindela purpurea Group (Coleop.: Cicindelidae).

By E. Graywood Smyth, Entomologist, W. R. Grace & Co. Sugar Estates, Trujillo, Peru.

In all the great variation and world wide distribution of this remarkable genus of tiger beetles, *Cicindela,* embracing over 700 named species and varieties, are no others which rival in exotic beauty the varieties of the *purpurea* group. And it is noteworthy that these varieties, in common with those of the *scutellaris, sexguttata* and *formosa* groups, reach their highest color development and greatest diversity of pattern in certain mid-western states, notably Kansas and Colorado. Coleopterists residing in those states, and enjoying thereby the advantage of first hand acquaintance with these divergent and highly developed geographic races, are in a most favorable position to adequately appraise and evaluate them, and to render fair judgment on their proper classification.

I have characterized this (8, p. 197) as the most difficult group in the genus *Cicindela* in America, and the proof of my statement lies in the fact that our two foremost authorities on the Cicindelidae, Charles W. Leng and Walther Horn, can exactly agree on the status of only six out of seventeen recognized species and varieties in the group. A recent synopsis (5), purporting to clear up the matter of their classification, has left the group in no less a state of confusion than it was. The writer disagrees, in several cases, with all of the above authorities, and bases his conclusions upon a knowledge of the living insects and their habits, and of their phylogeny and ontogeny.

There will, no doubt, always be this cleavage of opinion between—(a) those systematists who depend wholly upon the literature and upon dried museum specimens, and (b) those who, knowing by necessity the literature and collections available, believe in checking against the knowledge thus obtained the broader facts of habit, ecology, environmental factors, and all obtainable data gleaned from personal contact with the living insect. The writer has lived among, actually camped beside, the tiger beetles at every opportunity for the past thirty-odd years, from Atlantic to Pacific, from the Yellowstone to Cen-

tral America, has spent long hours over large series of many species, and has chased them with net, or studied the habits of their larvae, more days than he has eaten apples in his lifetime. He feels, therefore, that he almost knows the genus *Cicindela* in America, and is in position to take issue with such as, very patently, base their conclusions upon faulty and inadequate premises. As one who believes in following a middle path between extremes, and with sincere desire to aid those students who, like himself, have been intrigued by the high merits of these handsome beetles, he offers this contribution in a hope of clarifying the still prevalent confusion in the classification of the *purpurea* group.

In his recent answer to the writer's criticism of the Nicolay and Weiss Synopsis of the Cicindelidae (Purpurea Group) (5) Mr. Nicolay has made plain (4, p. 154) what most Cicindelists, lacking opportunity to verify, have long believed or suspected, namely, that the two stem forms *purpurea* Oliv. and *limbalis* Klug may be properly treated as distinct species. Not, indeed, from any notable dissimilarity of structure does he conclude this, but from their very different habitat, and from the fact that, even when occurring in the same locality, they show no tendency to intermingle or interbreed. This knowledge is a definite step forward, and makes very logical the writer's recently expressed opinion (8, p. 203) that all varieties (or so-called species and subspecies) in the group, with exception of *decemnotata* Say and *pugetana* Casey, may be correctly classified as varieties of either *purpurea* or *limbalis*. There are two decided reasons for this point of view, which have been too often overlooked or not considered. First, there are no stable morphological characters yet known that can be depended upon to separate one variety from another, all dependence being placed upon pilosity (which is very unstable), surface lustre, color and maculation. Secondly, the varieties (geographic races) in either species blend very gradually one into another wherever the distributional boundaries separating them overlap. This applies to every one of the varieties thus far described except *propinqua* Knaus, and in this case the morphological characters at once identify it as closely related to *denverensis* Casey, the lack of intermediate forms being due solely to our failure to have thus far discovered them.

How, may we ask, can two morphologically identical varieties of exactly similar habits, differing only in color and markings, even though separated from one another in distributional limits by a considerable distance, be possibly considered distinct species when every grade of intermediate or transition form can be found between them in the intervening terraine? To pronounce them separate species (viz., *limbalis* Klug and *splendida* Hentz), and to associate the intermediate forms (*transversa* Leng; *cyanocephala* Varas) with either the one or the other, as the notion strikes one, is neither logical nor rational. It is contrary to the facts in the case.

The fallacy of this conception is proven by the following anomaly. Mr. Leng considers *transversa* to be a variety of *splendida*, and *cyanocephala* a variety of *limbalis*. The authors of the Synopsis reverse this, and consider *transversa* as a variety of *limbalis*, and *cyanocephala* a variety of *splendida*. Whom should we follow as our authority? Have the two varieties *transversa* and *cyanocephala* shifted their colors, or changed their allegiance, between the dates on which the two opinions were published? Plainly something is wrong, yet the answer is very simple: for *splendida* is not a valid species, but merely a variety of *limbalis*, in common with *transversa* and *cyanocephala*. How simple it all is, after all. And we can only marvel at the convenience of a philosophy that considers transition forms in eastern Kansas between *transversa* and *splendida*, and between *limbalis* and *cyanocephala*, as "hybrids," and cites as evidence the existence of hybrids in fish (4, p. 131).

Of the seventeen species and varieties which the writer considers as belonging to the two stem species, the following may be classified as varieties (geographic races) of *purpurea* Oliv.: (1) *auduboni Lec.* 1845 (= *graminea* Schn. ex parte); (2) *nigerrima* Leng (= *auduboni* Lec. 1854); (3) *auguralis* Casey; (4) *cimarrona* Lec.; (5) *lauta* Casey; (6) *mirabilis* Casey.

The following may be considered varieties of *limbalis* Klug: (1) *spreta* Lec. 1848; (2) *transversa* Leng; (3) *cyanocephala* Varas; (4) *splendida* Hentz; (5) *ludoviciana* Leng; (6) *denverensis* Casey; (7) *plattensis* Smyth (= *conquisita* Casey fide Nicolay); (8) *propinqua* Knaus; (9) *sedalia* Smyth.

In either of these groups, intermediates (transition forms)

may be found between any two nearest related varieties (except in *propinqua*), definitely proving their relationships. But there is no reason whatever to confuse the varieties of the two species, even though anatomically similar, for their habits and habitat are very distinct, as the writer has previously emphasized (8, p. 203). Contrarily, our reasons for considering *decemnotata* and *pugetana* as distinct from all the others are that, not only are they quite unique and easily separable from all the others anatomically, but there occur no intermediate forms between either of them and any of the others named above. Intermediate forms between the two, however, may yet be found, as they seem fairly closely related.

In defending his position in the placement of certain varieties, Mr. Nicolay states (4, p. 128) that the Synopsis of the Cicindelidae has been "almost entirely a task of collecting and consolidating the views and conclusions of our predecessors. There is very little that we have changed. . . ." By predecessors we presume that he refers to Mr. Leng and Doctor Horn. Let us examine, specifically, just how faithfully the Synopsis adheres to this principle, which, if logically carried out, might indeed be justifiable.

(1) *C. purpurea* Oliv. All agree on this as *the* stem species.

(2) *C. auduboni* Lec. Nicolay and Weiss agree with Mr. Leng (3, p. 40) in placing it as a variety of *purpurea,* but Doctor Horn (2, p. 80) does not even honor it with that distinction, calling it a mere color phase of *purpurea.*

(3) *C. nigerrima* Leng. Like the preceding, Horn considers this a mere color phase of *purpurea,* though the others, we believe rightly, call it a variety. It is, apparently, merely a melanic form, yet its genetic divergence from *auduboni* has been noted (7, p. 428) on the western prairie, where the two occurred together and it chose isolated spots of darker soil.

(4) *C. auguralis* Casey. Although Leng considers this a synonym of *auduboni* (which is a variety of *purpurea*), and Horn calls it a "larger race" of *purpurea,* and although Casey described it as a variety of *purpurea,* Nicolay, by an anamorphosis all his own, insists that it is a variety of *limbalis.* He bases this conclusion on the appearance of the type specimen, which to him looks like *limbalis* because it has "the middle band

touching the sides and of course at right angles to them" (4, p. 130). It might profit him, we believe, to examine the large series of mountain forms in some of our western collections, showing every intermediate stage (transition form) between *auguralis* and *audubonì* on the one hand, and between *auguralis* and *cimarrona* on the other, the matter depending largely upon the altitude from which the specimen was secured (8, p. 199). As a matter of fact, *auguralis* may itself be well considered a transition form between *audubonì* (and *nigerrima*) of the plains and *cimarrona* of the highest plateaus. If one were to strictly follow Mr. Nicolay's principle of not "recognizing the intermediates between species and varieties" (5, p. 343), as he interprets that phrase, there would seem little reason to continue use of the name *auguralis*. Certainly it is very risky to form judgments from the superficial appearance of type specimens (as also proven by his first judgment on *mirabilis*) (4, p. 153).

(5) *C. cimarrona* Lec. This is considered a valid species by Leng, and by Doctor Horn a "larger race" of *purpurea*. What distinction the latter makes between a "larger race" and a variety we are not in position to say, but the difference must be small, since nearly all our "varieties" in *Cicindela* are, in fact, geographic races. It is very understandable why Mr. Leng considered *cimarrona* as worthy of specific standing, since he had not at hand the intermediate forms to show him that such was not the case. But that hardly justifies present day revisionists in subscribing to the error (4, p. 129).

(6) *C. lauta* Casey. Mr. Leng gave this variety the standing of a species (as with the preceding, he lacked intermediate forms connecting it with *audubonì*), but Doctor Horn was more accurate, considering it a "larger race" of *purpurea*. Regarding this variety Horn says (1, p. 24): "Under the name *graminea* the unlucky Schaupp had thrown together under one name two very different races,—the flat, often large bellied form of the Pacific coast—*lauta* of Casey, and the parallel, more arched form from Colorado." Yet the authors of the Synopsis differ from both of these authorities, and sink the name *lauta* to synonymy. Were they in possession of some of the large,

blue-green forms from the Northwest, they might feel otherwise.

(7) *C. mirabilis* Casey. Leng places this as a variety of *lauta,* while Horn calls it a synonym of *lauta.* Nicolay and Weiss sank the name (5, p. 346) as a synonym of *auduboni.* It is, however, an easily distinguished and well established Californian variety of *purpurea,* and it is gratifying that Mr. Nicolay is now willing (4, p. 154) to restore it to its legitimate standing as such.

(8) *C. limbalis* Klug. Most of us prefer to consider this the other stem species of the group, on an equal footing with *purpurea.* Mr. Leng considers it a valid species, though Walther Horn lists it among the "larger races" of *purpurea,* on a par with *cimarrona* and *lauta,* with neither of which it has any but remote relationship. (It is this confused notion of comparative values among the races of *purpurea* and *limbalis,* shared by our best authorities, that has hampered proper arrangement of the beetles of this group for years.) Mr. Nicolay has fortunately settled the matter (4, p. 154) by describing the exact relationship of these two stem species (*purpurea* and *limbalis*) in the East, where they most approach each other morphologically and ecologically, yet are distinct in habit and do not intermingle.

(9) *C. spreta* Lec. The former confusion about this variety may be best explained by Dr. Horn's statement (1, p. 37): "*C. spreta* Lec. has been twice and certainly not harmoniously described by LeConte (once as dirty dark green and once as black)." Horn gives the name no standing, placing it as a synonym of *purpurea* (which ignores its different habits and type of maculation), but Leng correctly places it as a variety of *limbalis.* Nicolay and Weiss follow Leng in this conclusion, which they justify (5, p. 349) in order "to separate that form occurring only in the northeast which has the usual cupreous color more or less suffused with green." This makes improper the inclusion under this name of certain greenish aberrations from Colorado that have been heretofore wrongly determined as *spreta,* and are, in reality, *auguralis* (a variety of *purpurea*).

(To be continued)

Biological Races of Insects and their Bearing on Host Plant Resistance.

By Wm. P. Hayes, University of Illinois.[1]

The invasion of chinch bugs in the corn fields of the midwest during the summer of 1933 has created new interest in the matter of finding host plants that are resistant to insect attack. During the coming season, plant breeders, entomologists, and growers will more thoroughly test the strains of corn that are being recommended in certain states as chinch bug resistant. Similarly, workers are looking for strains of corn resistant to European corn borer and strains of wheat resistant to Hessian fly. Such investigations may reveal lines of attack useful to the farmer whose acreage of field crops is so extensive that the application of physical or chemical control measures is precluded because of impracticability.

Plants growing in the wild state are usually less injured by insects that attack them than are cultivated plants which seem to have acquired a greater degree of susceptibility. The characters which produce resistance in wild plants have through time been bred out of the cultivated crops (Imms, Recent Advances in Entomology, p. 240, 1931). However, we often find certain strains or individual plants that appear resistant to the injury of a particular pest. This absence of injury does not necessarily mean that a plant is resistant to attack, because the matter of host avoidance or host selection or preference enters strongly into consideration. The attacking insect may have avoided the particular uninjured plant due to its preference for others more to its liking.

Resistance usually implies a low degree of susceptibility. Very few plants are completely resistant to insect damage, so that we are usually compelled to recognize lesser degrees of resistance which we regard as either apparent resistance or partial resistance. Consequently, among those crops which exhibit partial resistance we have come to recognize what is now regarded as tolerance to insect injury. For the grower, a plant that can produce a good yield in spite of insect damage is almost

[1] Contribution from the Entomological Laboratories of the University of Illinois, No. 164.

as valuable as an immune or resistant one. The measure of resistance in a host plant is its degree of immunity or lack of susceptibility to insect damage, while tolerance is computed on the basis of infestation and yield. In other words, a plant strain with high infestation and high yield exhibits greater tolerance than a strain with low infestation and the same high yield. It is therefore apparent that low infestation and high yield are the desired factors in a resistant strain.

Unfortunately, most strains that have been bred by plant geneticists which show a high degree of resistance are low in yield and further breeding is necessary to develop the yield factor. As a result, some plant geneticists and entomologists engaged on this problem have come to regard insect tolerance in a plant as a more desirable factor than resistance and one more easily obtainable. Wardle (Problems of Applied Entomology, 1929, p. 17) states that tolerance is "due possibly to strong and vigorous growth or to a reaction of the host tissues that tends to lessen the injury." If this is true, tolerant strains are more apt to be the resultant of environmental factors such as soil conditions, climate, crop nutrition, or some physiological factor, such as vigor, or physico-chemical factors such as density of cell-sap, sugar content, hydrogen ion concentration, osmotic pressure or electrical conductivity.

Geneticists are of the opinion that resistance, and perhaps tolerance as well, is due to the presence of some heritable factor or factors. Most work to date on this problem has been done by plant geneticists breeding for factors in plants resistant to insects. Practically, no attention has been devoted to the genetics of the attacking insect. It has been asserted by some workers that biological races or physiological varieties of insects are the products of mutant genes. It is known that among insects such as aphids and certain coccids, that alternation of host plants has led to the development of biological races. In America, the European corn borer (*Pyrausta nubilalis* Hbn.) has two such races which differ considerably in their feeding habits. The eastern strain is decidedly polyphagous. At least 200 larval food plants are known. It differs also in the production of two generations a year. The western race is decidedly limited in the number of food plants, less than a dozen

are of any importance, and there is but one generation a year.

Williston (Amer. Nat. 42:184, 1908) points out that ascendant phyla are more plastic than stabilized older phyla, which would indicate that the one-brooded, limited-host-plant, race of the European corn borer in the western area is more primitive than the eastern race. Wardle and Buckle (Principles of Insect Control, p. 2) assert that the polyphagous habit in insects is the more primitive. Such being the case the eastern race would be the older. Regardless of these divergent viewpoints it is clearly apparent from the two examples cited that it is the plasticity of a given insect race that must be taken into account in studying host-resistance or tolerance.

If as stated above, plants growing in the wild state are usually less injured and cultivated plants have acquired a greater degree of susceptibility, our search among plant strains for desired factors should lead us to the older and more resistant kinds.

Painter, Salmon and Parker (1931) have shown the Hessian fly (*Phytophaga destructor* Say) to have two biological races. Their studies seem to show that "these biological or physiological strains are genetically distinct. The evidence available also indicates that the population of fly in any one locality consists of a mixture of two or more strains which differ in their ability to infest the several varieties of wheat."

Up to the present time, most breeding work has been done on the assumption that the attacking species will react in the same manner under all conditions. If, as we maintain, resistance is inherited, is it not reasonable to think that various degrees of ability to injure or attack may likewise be inherited? Whether this ability is a genetic character of the species or is brought about by ecological conditions, it remains pertinent that a so-called resistant host plant will not exhibit resistance under all conditions. A strain of corn that may be resistant to the European corn borer in the western area of infestation, where the variety of host plants is limited, would scarcely be expected to show as marked resistance in the eastern area of infestation where it is subject to attack by a biological race of a different nature, whose food habits exhibit greater plasticity,

and which produces more generations per year. It would seem that the problem of the corn-breeder in producing a resistant strain for the one-brooded, limited host-plant race may be more capable of solution than the task of producing plants resistant to the two-brooded, polyphagous eastern race.

The situation, as just described, is more complicated in those areas of infestation where the two biological races of insects overlap. This condition occurs in the case of the Hessian fly described by Painter, Salmon, and Parker (*l.c.*) in which a given population of the insect in any one locality consists of a mixture of races with varying degrees of ability to inflict damage on the host. In this insect we have a species that differs from the European corn borer in being restricted to fewer food plants, which, theoretically, should make breeding for resistance a simpler task. In other words, were it not for the differences occurring in our biological races of the attacking species, it would be a far simpler problem to breed resistant hosts.

Genetic studies on insects have shown the vast number of varieties that may be bred in the laboratory. Such variations must also exist in nature and it seems imperative to know more of the genetics of our injurious species in order to assist us in breeding plants that are resistant to them. It is highly probable that we shall never be able to breed hosts that are entirely resistant against all biological races of a given species, which, at the same time, will have desirable agronomic characteristics. Each biological race must be considered as a distinct unit. It would seem, also, that the subject of host tolerance is one that must be given deeper study. Tolerant plants may be developed by the selection and breeding of those which show some degree of resistance, tolerance, or greater recuperative power. Tolerance in plants may also be enhanced by giving more attention to such matters as crop nutrition, better soil conditions, time of planting, and better seed, all of which can be more or less controlled by the grower. Even then, particularly with insects that prefer a wide choice of food plants, our developed resistance or tolerance may not be permanent because the attacking insects may be able to adapt themselves to our produced strains and accept them as new hosts.

Laboulbenia formicarum Thaxter, a Fungus Infesting some Idaho Ants, and a List of its Known North American Hosts (Hym.: Formicidae).

By A. C. Cole, Jr., East Lansing, Michigan.

Workers of *Formica sanguinea* subsp. *puberula* Emery, *F. sanguinea* subsp. *subnuda* Emery and *F. subpolita* var. *camponoticeps* Whlr., collected by the writer in the Snake River Plains section of Idaho, were rather prominently infested with the ant fungus, *Laboulbenia formicarum* Thaxter. The infested colonies of *F. sanguinea subnuda* were found beneath rocks in a subalpine meadow, while colonies of the other species nested in the open sagebrush semidesert areas. Where one occupant of a colony was affected many others of the same nest were likewise diseased. Thus the spread occurred apparently within the nests. It is rather surprising that this fungus was found, inasmuch as summer temperatures of the region are so high and the relative humidity so low.

The ants now known to bear the fungus are as follows:

1. Formica pallide-fulva subsp. schaufussi Mayr. Forest Hills, Massachusetts (J. Bequaert).
2. F. pallide-fulva schaufussi var. incerta Emery. Sioux City, Iowa (C. N. Ainslie); Urbana, Illinois (M. R. Smith).
3. F. neogagates Emery. Cambridge, Massachusetts (Thaxter); Urbana, Illinois (M. R. Smith).
4. F. fusca Linn. Sioux City, Iowa (C. N. Ainslie).
5. F. fusca var. argentea Whlr. Urbana, Illinois (M. R. Smith).
6. F. subpolita var. camponoticeps Whlr. Hollister and Twin Falls, Idaho (Cole).
7. F. sanguinea subsp. subnuda Emery. Rogerson and Twin Falls, Idaho (Cole).
8. F. sanguinea subsp. puberla Emery. Nampa, Idaho (Cole).
9. Lasius niger var. americanus Emery. Cambridge, Massachusetts (Thaxter); Columbus, Ohio (M. R. Smith); Raleigh, North Carolina (Z. P. Metcalf).
10. L. niger var. neoniger Emery. Urbana, Illinois (M. R. Smith); Ellisville, Massachusetts (W. M. Wheeler).

The Duties of the Queen Wasp, Polistes pallipes (Hym.: Vespidae).

By PHIL RAU, Kirkwood, Missouri.

In reading accounts of the life history of *Polistes* wasps, one is led to believe that the founding queen, who when alone does all of the work of nest building and nest provisioning, ceases work when the first generation of workers appears and thereafter becomes a mere egg-laying machine. I was anxious to know just what the queen's duties are after the workers appear so I spent six hours, on July 14, 1929, on a step-ladder watching a queen and eight workers.

Sometime before the emergence of the workers, this queen was marked with a drop of paint; there is no outward differentiation between the queen and workers of this species so that a distinction by marking had to be made before the workers were born to set her apart.

Even though this queen had eight workers on the nest, she flew off at 10 a. m., remained in the field for three minutes and returned empty handed. At 10:35 a. m. she again ventured out for three minutes, returned with a mouthful of paper pulp, and then spent five minutes applying it to an unfinished cell.

She then spent some time poking her head into one or another of the cells, touching the larvae with her antennae, and sometimes kept it there for several minutes. This phenomenon of course is one of the little tricks practiced by wasps to get larva to spit up saliva which the adults drink. The workers practice it and so do the queens when alone on the nest. This little observation shows that the queens, or at least this queen, has not lost the desire to practice it even if the nest abounds with workers who are supposed to do all the nursing.

The workers brought in caterpillar meat from time to time and fed it direct to the larvae but sometimes they turned it over to one of the workers on the nest who in turn, after chewing it for a while, would apportion it to the larvae. One worker (marked with a white dot) shared half of a ball of yellow caterpillar meat with the queen. The latter chewed it for a

short while, then gave one half of it to one of the workers and the other half she fed direct to a larva; often during the day incoming workers with balls of wet paper pulp would divide it with the queen who would apply it to an unfinished portion of the cell.

The third time the queen left the nest that day was 2:47 p. m.; then she remained out for half an hour and returned empty handed. The observations show that one queen, at least, even though she had an abundance of workers to carry on the nesting activities, did not degenerate into a mere egg-laying machine, but took an active interest in the business affairs of the colony, actually doing the same kind of work as the workers. Queens show a great deal of individuality in behavior, and I wonder if another queen under similar circumstances would behave in precisely the same way. In another nest observed later, a marked queen often relieved an incoming worker of its load of pulp and applied it herself to an unfinished cell; and another observation during the same year showed that a certain queen *pallipes* spent an enormous amount of time away from the nest, and this even though she had a large number of workers. In still another nest the queen went out foraging with her previous regularity, even though she had a force of five workers.

One cannot spend six hours watching a colony of wasps without noting other items of behavior that one has not especially sought. I was fortunate in seeing a newly adult worker bite its way out of its cell early in the morning and remain in hiding on top of the nest nearly all day. She was shy and seemed to be afraid of the queen, since she would only venture to the active part of the nest during the queen's absence and would rush back to her hiding place the moment the queen returned. One of the workers (marked in blue) that was especially active in bringing in loads of caterpillar flesh, singled out this shy young one, and to my amusement gave the juvenile its first lesson in nursing. "Blue Dot" came in with a big load of flesh, flew immediately to the roof, pushed the shy one out from its hiding place, thrust the entire meat market into its

front legs and then flew from the nest. This shy one had a lesson to learn and she had to do it without further instruction, and this is how she handled this big mass of meat. She evidently did not know what to do with it, and for more than an hour turned it round and round in her forelegs, much as a squirrel would manipulate a nut, and at short intervals she would imbed her jaws into the flesh and swallow the juices until the great mass was reduced to half its original size. Then the portion that was left was separated into two parts, one going to feed a larva in one of the cells, and the other was again manipulated with the jaws until it gradually became smaller and smaller and finally the last vestige disappeared down her own gullet. The disposal of the last portion demonstrated that not only do the adults use caterpillar juice for food but also that they devour the flesh as well. The moment the food was gone this youngster made a careful toilet for several minutes, and then beat a hasty retreat to the hiding place on top of the nest. Late in the afternoon the shy one ventured among the crowd at the open face of the nest, often poking her head into the cells with larvae, and was learning so rapidly that before I left I saw her take several loads of meat from the incoming foragers and feed them to the larvae in the approved fashion.

To summarize then, the founding queens of *P. pallipes* do not devolve into egg-laying machines the moment the workers appear, but continue to take an active interest in building, foraging and nursing; also the newly emerged worker remains on the nest for the first day and, in an awkward fashion, possibly through imitation, learns to play nurse to the larvae.

Longevity and the Moulting of the Myriapod, Spirobolus marginatus Say.*

A myriapod fully five inches long and about one-fourth inch in diameter was brought to me on June 8, 1930. The animal lived quite contentedly among the rotten wood in a glass fish globe until its death on January 20, 1932. This made the length of life in captivity almost a year and eight months. It

* Kindly identified by C. V. Chamberlin.

ate of the rotten wood, letting the frass accumulate in the jar. It also ate raw potato, but would readily leave the potato for the leaves of cabbage.

The rotted wood was occasionally sprinkled with water, and remained the myriapod's main supply of food; it remained surprisingly free of fungus, although the cabbage was densely covered with a webby growth soon after being placed in the jar. The myriapod itself as well as the large amount of frass in the jar was immune from fungus attacks. This immunity of both the animal and its excrement was undoubtedly due to the influence of the creature's musky secretions. Sinclair (Camb. Nat. Hist., Peripatus, Myriapods & Insects, p. 36, 1895) says that the millepeds rely for protection on the fluid secreted by the stigmata repugnatoria. This fluid has been shown to contain prussic acid, and has a very unpleasant odor.

The jar at one time was nearly full of woody pellets of excrement, and on July 18, 1931, I noticed that the myriapod had made its way through this mass and rested in a coiled position at the bottom of the jar. A week later when I dug down to the bottom I noticed that a brownish secretion oozed from its body at the joints of several segments. A month later, when it still remained at the bottom, I again dug down, and then found large pieces of shedding skin adhering to the body. This showed that a complete moult had occurred during the month. I replaced the frass, and on September 1st, the myriapod came to the top of its own volition, and resumed feeding on the rotten wood, and so continued until death.—PHIL RAU, Kirkwood, Missouri.

Plecoptera as Food for Bank Swallows.

Apropos of the recent discussion by Hamilton (The Auk, 49, No. 3, 1932, and 50, No. 3, 1933), by McAtee (Smithsonian Misc. Col. 85, No. 7, 1932) and Knappen (The Auk, 51, No. 1, 1934) it may be pertinent to record the presence of Plecoptera in the stomach contents of a Bank Swallow (*Riparia r. riparia*).

In the examination of more than 60 stomachs of Bank Swallows, both adults and young, collected in the Oneida Lake, New York region, I encountered remains of these insects in but a single bird. This swallow was an adult male taken from a burrow on the south bank of Fish Creek about eight miles northeast of Oneida Lake on May 15, 1931.

The stomach of this bird was full. An examination of the content showed that the bulk of it (70 per cent) consisted of two-winged flies (Diptera) principally Muscidae, although

crane-flies (Tipulidae) also were represented. Beetles (Coleoptera), consisting principally of small dung beetles (Aphodius: Scarabaeidae), amounted to 28 per cent. Traces of Orthoptera (Gryllidae), Heteroptera and Homoptera (Fulgoridae) were present while several small hymenopterous forms (Braconidae and possibly others) amounted to 1 per cent. In addition, this stomach contained two small adult stoneflies (Perlidae: Plecoptera) comprising 1 per cent of the food eaten. These delicate insects had been little mangled in the act of deglutition and one of the specimens was sent to Dr. P. W. Claassen of the Department of Entomology, New York State College of Agriculture, who determined it as *Alloperla mediana* Banks.

During the course of several seasons spent in investigating the Bank Swallow and other birds in the Oneida Lake region, I have often observed adult stoneflies clinging to the vertical sandy banks along Fish Creek where thousands of Bank Swallows nest. Excellent breeding places for these insects are afforded in the waters of Fish Creek and at least some of its tributaries. The comparative abundance of stoneflies can not be denied. It seems strange, therefore, that these weak-flying, soft-bodied insects do not form a greater part of the diet of Bank Swallows in this territory than is indicated by our findings.

Mr. W. L. McAtee informs me that the U. S. Biological Survey has no record of the presence of stoneflies in the stomachs of Bank Swallows and, so far as I have been able to determine, this constitutes the first published record of such occurrence.—DAYTON STONER, New York State Museum, Albany, New York.

The Sixth International Congress of Entomology.

At the meeting of the Entomological Society of America, at Pittsburgh, Pennsylvania, December 27-29, 1934, it was announced that Prof. O. A. Johannsen, of Cornell University, member of the Permanent Executive Committee of the International Congresses of Entomology, had received a message from Prof. I. Bolivar y Urrutia, President of the Sixth International Congress, that the Congress will meet at Madrid, in the first half of September, 1935. Particulars will be furnished later.

The Compte Rendu of the Fifth Congress (Paris, 1932) states that invitations for holding the Sixth Congress were received from Egypt, Spain and Germany. The Congress voted to accept the invitation of Spain for 1935 and that the Seventh Congress be held in Germany (page 59).

Orthoptera New to Colorado

Since the publication of Mr. Hebard's "Orthoptera of Colorado" (Proc. Acad. Nat. Sci. Phila. LXXXI: 303-425, 1929), the writer has collected two species of Tettigoniidae and one of Acrididae not then recorded from the state. No one of these may be considered accidental, each species being represented by several specimens.

Scudderia texensis Saussure & Pictet is represented in the University of Colorado collection by a male taken at Boulder, Colorado, September 20, 1923, by S. Miller. Prof. F. B. Isely took the following specimens in 1931: one male near Roggen, Colorado, August 6; two males at Boulder, Colorado, August 14. On August 29, 1933, I took a female of this species in a vacant lot in Boulder. It is evidently established at Boulder, at least, but is comparatively rare.

Cyphoderris monstrosa Uhler has already been recorded from Colorado, its southeastern limit, by Mr. Hebard in his recent revision of the genus (Tran. Amer. Ent. Soc. LIX: 363-375, 1934). In addition to the specimen there recorded, two other males were collected at the same time and place. All were located, while stridulating, at about 9 P. M., August 17, 1932. They were in pine forest in the mountains of the Park Range, west of Crowley, Colorado, and at an elevation of about 8,800 feet above sea-level.

On September 8, 1932, I collected in the sand hills near Roggen, Colorado, a female of a species of *Eremiacris*. Mr. Rehn, who examined the specimen, suggested an attempt to get additional ones. Consequently, a trip to the same area was made on September 9, 1933, and an intensive search of several hours, chiefly in grasses of several species of *Andropogon*, yielded twenty-two specimens,—nine males and thirteen females. Several specimens were sent to Messrs. Rehn and Hebard, who determined them as *Eremiacris pallida* (Bruner), a species rather widely distributed west of the southern Rocky Mountains but not previously found so far to the northeast. The Roggen specimens, however, are shorter than the dimensions given by Rehn and Hebard in their 1909 key (Proc. Acad. Nat. Sci. Phila. LXI: 133-134) to *Paropomala* Scudder (*Eremiacris* Hebard, in part). The species cannot be confused with *Eremiacris virgata* (Scudder), which has been taken in southeastern Colorado.—Gordon Alexander, Department of Biology, University of Colorado, Boulder, Colorado.

List of the Titles of Periodicals and Serials Referred to by Numbers in Entomological Literature in Entomological News.

1. Transactions of The American Entomological Society. Philadelphia.
2. Entomologische Blätter, red. v. H. Eckstein etc. Berlin.
3. Annals of the Carnegie Museum. Pittsburgh, Pa.
4. Canadian Entomologist. London, Canada.
5. Pysche, A Journal of Entomology. Boston, Mass.
6. Journal of the New York Entomological Society. New York.
7. Annals of the Entomological Society of America. Columbus, Ohio.
8. Entomologists' Monthly Magazine. London.
9. The Entomologist. London.
10. Proceedings of the Ent. Soc. of Washington. Washington, D. C.
11. Deutsche entomologische Zeitschrift. Berlin.
12. Journal of Economic Entomology, Geneva, N. Y.
13. Journal of Entomology and Zoology. Claremont, Cal.
14. Entomologische Zeitschrift. Frankfurt a. M., Germany.
15. Natural History, American Museum of Natural History. New York.
16. American Journal of Science. New Haven, Conn.
17. Entomologische Rundschau. Stuttgart, Germany.
18. Internationale entomologische Zeitschrift. Guben, Germany.
19. Bulletin of the Brooklyn Entomological Society. Brooklyn, N. Y.
20. Societas entomologica. Stuttgart, Germany.
21. The Entomologists' Record and Journal of Variation. London.
22. Bulletin of Entomological Research. London.
23. Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricultura in Portici. Italy.
24. Annales de la société entomologique de France. Paris.
25. Bulletin de la société entomologique de France. Paris.
26. Entomologischer Anzeiger, hersg. Adolf Hoffmann. Wien, Austria.
27. Bolletino della Società Entomologica. Genova, Italy.
28. Ent. Tidskrift utgifen af Ent. Föreningen i Stockholm. Sweden.
29. Annual Report of the Ent. Society of Ontario. Toronto, Canada.
30. The Maine Naturalist. Thornaston, Maine.
31. Nature. London.
32. Boletim do Museu Nacional do Rio de Janiero. Brazil.
33. Bull. et Annales de la Société entomologique de Belgique. Bruxelles.
34. Zoologischer Anzeiger, hrsg. v. E. Korschelt. Leipzig.
35. The Annals of Applied Biology. Cambridge, England.
36. Transactions of the Entomological Society of London. England.
37. Proceedings of the Hawaiian Entomological Society. Honolulu.
38. Bull. of the Southern California Academy of Sciences. Los Angeles.
39. The Florida Entomologist. Gainesville, Fla.
40. American Museum Novitates. New York.
41. Mitteilungen der schweiz. ent. Gesellschaft. Schaffhausen, Switzerland.
42. The Journal of Experimental Zoology. Philadelphia.
43. Ohio Journal of Sciences. Columbus, Ohio.
44. Revista chileña de historia natural. Valparaiso, Chile.
45. Zeitschrift für wissenschaftliche Insektenbiologie. Berlin.
46. Zeitschrift für Morphologie und Ökologie der Tiere. Berlin.
47. Journal of Agricultural Research. Washington, D. C.
48. Wiener entomologische Zeitung. Wien, Austria.
49. Entomologische Mitteilungen. Berlin.
50. Proceedings of the U. S. National Museum. Washington, D. C.
51. Notulae entomologicae, ed. Soc. ent. Helsingfors. Helsingfors, Finland.
52. Archiv für Naturgeschichte, hrsg. v. E. Strand. Berlin.

53. Quarterly Journal of Microscopical Science. London.
54. Annales de Parasitologie Humaine et Compareé. Paris.
55. Pan-Pacific Entomologist. San Francisco, Cal.
56. "Konowia". Zeit. für systematische Insektenkunde. Wien, Austria.
57. La Feuille des Naturalistes. Paris.
58. Entomologische Berichten. Nederlandsche ent. Ver. Amsterdam.
59. Encyclopédie entomologique, ed. P. Lechevalier. Paris.
60. Stettiner entomologische Zeitung. Stettin, Germany.
61. Proceedings of the California Academy of Sciences. San Francisco.
62. Bulletin of the American Museum of Natural History. New York.
63. Deutsche entomologische Zeitschrift "Iris". Berlin.
64. Zeitschrift des österr. entomologen-Vereines. Wien.
65. Zeitschrift für angewandte Entomologie, hrsg. K. Escherich. Berlin.
66. Report of the Proceedings of the Entomological Meeting. Pusa, India.
67. University of California Publications, Entomology. Berkeley, Cal.
68. Science. New York.
69. Comptes rendus hebdoma. des séances de l'Académie des sciences. Paris.
70. Entomologica Americana, Brooklyn Entomological Society. Brooklyn.
71. Novitates Zoologicae. Tring, England.
72. Revue russe d'Entomologie. Leningrad, USSR.
73. Quarterly Review of Biology. Baltimore, Maryland.
74. Sbornik entomolog. národniho musea v Praze. Prague, Czechoslavokia.
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79. Koleopterologische Rundschau. Wien.
80. Lepidopterologische Rundschau, hrsg. Adolf Hoffmann. Wien.
81. Folia myrmecol. et termitol. hrsg. Anton Krausse. Bernau bei Berlin.
82. Bulletin, Division of the Natural History Survey. Urbana, Illinois.
83. Arkiv för zoologie, K. Svenska Vetenskapsakademien i. Stockholm.
84. Ecology. Brooklyn.
85. Genetics. Princeton, New Jersey.
86. Zoologica, New York Zoological Society. New York.
87. Archiv für Entwicklungs mechanik der Organ., hrsg. v. Roux. Leipzig.
88. Die Naturwissenschaften, hrsg. A. Berliner. Berlin.
89. Zoologische Jahrbücher, hrsg. v. Spengel. Jena, Germany.
90. The American Naturalist. Garrison-on-Hudson, New York.
91. Journal of the Washington Academy of Sciences. Washington, D. C.
92. Biological Bulletin. Wood's Hole, Massachusetts.
93. Proceedings of the Zoological Society of London. England.
94. Zeitschrift für wissenschaftliche Zoologie. Leipzig.
95. Proceedings of the Biological Soc. of Washington, Washington, D. C.
96. La Cellule. Lierre, Belgium.
97. Biologisches Zentralblatt. Leipzig.
98. Le Naturaliste Canadien. Cap Rouge, Chicoutimi, Quebec.
99. Mélanges exotico-entomologiques. Par Maurice Pic. Moulins, France.
100. Bulletin Intern., Académie Polonaise des Sci. et des Lett. Cracovie, Poland.
101. Tijdschrift voor entomologie, Nederlandsche Entomol. Ver., Amsterdam.
102. Entomologiske Meddelelser. Entomologisk Forening, Copenhagen.
103. Journal of the Kansas Entomological Society. Lawrence, Kansas.
104. Revista de la Sociedad entomologica Argentina, Buenos Aires.
105. Revista Entomologia, São Paulo, Brazil.
106. Anales Sociedad Cientifica Argentina, Buenos Aires.
107. Stylops: a Journal of Taxonomic Entomology, London.
108. Revista, Col. Nac. Vicente Rocafuerte, Guayaquil.
109. Arbeiten uber morphologische und taxonomische entomologie aus Berlin-Dahlem.
110. Arbeiten ueber physiologische und angewandte entomologie aus Berlin-Dahlem.
111. Memorias do Instituto Oswaldo Cruz. Rio de Janeiro.

Entomological Literature

COMPILED BY LAURA S. MACKEY UNDER THE SUPERVISION OF E. T. CRESSON, JR.

Under the above head it is intended to note papers received at the Academy of Natural Sciences, of Philadelphia, pertaining to the Entomology of the Americas (North and South), including Arachnida and Myriopoda. Articles irrelevant to American entomology will not be noted; but contributions to anatomy, physiology and embryology of insects, however, whether relating to American or exotic species will be recorded.

The **figures within brackets** [ ] refer to the journal in which the paper appeared, as numbered in the list of Periodicals and Serials published in our January and June issues. This list may be secured from the publisher of ENTOMOLOGICAL NEWS for 10c. The number of, or annual **volume**, and in some cases the part, heft, &c. the latter **within** ( ) follows; then the pagination follows the **colon** :

All continued papers, with few exceptions, are recorded only at their first installments.

(*) Papers containing new forms or names not so stated in titles, have an * within parentheses thus (*) following the pagination of reference to paper.

(S) Papers pertaining exclusively to neotropical species, and not so indicated in the title, have the symbol (S) at the end of the title of the paper.

For records of Economic Literature, see the Experiment Station Record, Office of Experiment Stations, Washington. Also Review of Applied Entomology, Series A, London. For records of papers on Medical Entomology, see Review of Applied Entomology, Series B.

Note. Titles of papers containing new forms or new names will be indicated by an asterisk within parentheses at end of reference, (*).

Papers published in the Entomological News are not listed.

GENERAL.—Fall, H. C.—A choice of words. [4] 66: 233-234. **Felt, E. P.**—Classifying symbols for insects. [6] 42: 373-392. **Goding, F. W.**—Obituary. By C. E. Olsen. [6] 42: 443-449.

ANATOMY, PHYSIOLOGY, ETC.—André, M.—L'epistome et l'appareil buccal des Caeculus (Acariens prostigmatiques). [58] 9: 93-96, ill. **Ball, E. D.**—The number of generations of the beet leafhopper under natural conditions. [12] 27: 945-959, ill. **Bodenheimer, F. S.**—Ueber die temperaturabhaengigkeiten der insekten. [89] 66: 113-151, ill. **da Costa Lima, A.**—Applicação de uma technica de para a montagem da terminalia dos mosquitos. [105] 4: 499-501, ill. **Eckert, J. E.**—A gynandromorph honeybee. [12] 27: 1079-1082, ill. **Hambleton, J. I.**—Bee behavior. [76] 1934: 544-546, ill. **Hasebrock, K.**—Industrie-und grosstadt als ursache des neuzeitlichen vererbbaren melanismus des schmetterlinge in England und Deutschland. [Forsch. u. Forsch. Berlin] 10: 307-398, ill. **Herms & Ellsworth.**—Field tests of the efficacy of colored light in trapping insect pests. [12] 27: 1055-1067, ill. **Herriot, A. D.**—The renewal and replacement of the stylets of sucking insects during each stadium and the method of penetration. [Can. Jour. Res.] 11: 602-612, ill. **Holdaway & Mulhearn.**—Sheep sweat a factor in blowfly attack of sheep. [31] 134: 813-814. **Hoskins & Craig.**—The olfactory responses of flies in a new type of insect olfactometer. [12]

27: 1029-1036, ill. **Lebedev, A. G.**—Ueber den gesetzmässigen zusammenhang zwischen bienen und pflanzen. [56] 13: 160-170. **Mayer, K.**—Beitrag zur sinnesphysiologie der schlupfwespe Nemeritis canescens (Ichneumonidae). [110] 1: 245-248. **Moore, W. G.**—The production of sterility in Drosophila melanogaster by x-ray treatment. [90] 68: 508-515. **Norris, M. J.**—Contributions towards the study of insect fertility. Adult nutrition, fecundity and longevity in the genus Ephestia. [93] 1934: 333-360. **Pictet, A.**—Instincts et survivance. [Lambillionea] 1934: 209-219. **Sen, S. K.**—The sucking apparatus of ticks. [31] 134: 664. **Stickney, F. S.**—The external anatomy of the parlatoria date scale, Parlatoria blanchardi, with studies of the head skeleton and associated parts. [U. S. D. A. Tech. Bul.] 421: 66 pp., ill. **Tirelli, M.**—Spostamento del pigmento nelle cellule della sierosa durante lo sviluppo embrionale nel Bombyx mori. [Bol. Z. Union Zol. Ital.] 5: 163-172, ill. **Vansell, G. H.**—Relation between the nectar concentration in fruit blossoms and the visits of honeybees. [12] 27: 943-945. **Warren, E.**—On the male genital system and spermatozoa of certain millipedes. [An. Natal. Mus.] 7: 351-402, ill. **Zacwilichowski, J.**—Ueber die innervierung und die sinnesorgane der flugel von schabe Phyllodromie germanica. [Bul Acad. Polonaise Sci. et. Let.] 1034, B. 2: 89-104, ill.

ARACHNIDA AND MYRIOPODA.—Davis, N. W.—A revision of the gen. Leiobunum (Opiliones) of the U. S. [Am. Midl. Nat.] 15: 662-705, ill. (*). **Exline & Hatch.**—Note on the food of the black widow spider. [6] 42: 449-450. **Mello-Leitao.**—Pequenas notas arachnologicas. Notas sobre os opilioes do Brasil. Ensaio sobre as Myrmarachninas do Brasil. [Bol. Mus. Nac. R. de Jan.] 8: 67-75; 9 (1): 99-114; 9 (2): 39-101, ill. (*). **Schroeder, C. R.**—The snake mite (Ophiomyssus serpentium). [12] 27: 1004-1014, ill. **Verhoeff, K. W.**—Beiträge zur systematik und geographie der Chilopoden. [89] 66: 1-112, ill. **Werner, F.**—Scorpiones, Pedipalpi. Bronns Klass. Ordnung. Tierreichs. V, (4) pp. 161-316, ill.

THE SMALLER ORDERS OF INSECTS.—Cowley, J.—The types of some genera of Odonata. [9] 67: 249-253. **Friederichs, K.**—Das gemeinschaftsleben der Embiiden und naheres zur kenntnis der arten. [52] 3: 405-444, ill. **Pycraft, W. P.**—Feather eaters [Mallophaga]. [Ill. London News] 95: 806, ill. **Tinkham, E. R.**—The dragonfly fauna

of Presidio and Jeff Davis Counties of the Big Bend region of Trans-Pecos, Texas. [4] 66: 213-218.

ORTHOPTERA.—Hebard, M.—The Dermaptera and Orthoptera of Illinois. [Bull. Ill. Nat. Hist. Surv.] 20: 125-279, ill. (*).

HEMIPTERA.—Brown, W. F.—The genus Chlorotettix in America, north of Mexico. [Univ. Kans. Sc. Bul] 21: 235-256, ill. (*). **de Carlo, J. A.**—Familia Belostomidae. Descriciones de especies nuevas procedentes del Brasil. [Bol. Mus. Nac. R. d. Jan.] 9 (1): 93-98, ill. **Cummings, C.**—The giant water bugs. (Belostomatidae). [Univ. Kans. Sc. Bull.] 21: 197-220, ill. (*). **Dow, R.**—The periodical cicada on Martha's Vineyard. [Bull. Boston Soc. Nat. Hist.] 1934: 3-5, ill. **Drake & Bondar.**—Concerning Brazilian Tingitidae. [Bol. Mus. Nac. R. d. Jan.] 8: 87-96, ill. (*). **Drake & Hambleton.**—Brazilian Tingitidae. [105] 4: 435-451. (*). **Hungerford, H. B.**—The genus Notonecta of the World. [Univ. Kans. Sci. Bul.] 21: 5-196, ill. **Johnston, H. G.**—Lygus lucorum re-discovered in North America (Miridae). [4] 61: 231-232, ill. **Shaw, J. G.**—A study of the Genus Brachymetra (Gerridae). [Univ. Kans. Sc. Bul.] 21: 221-234, ill. (*).

LEPIDOPTERA.—d'Almeida, R.—Studien ueber die gattung Terias. [14] 48: 115-118, ill. (S*). **Bell, E. L.**—Studies in the Pyrrhopyginae. [6] 42: 393-440, ill. **Crumb, S. E.**—A classification of some noctuid larvae of the subfamily Hypeninae. [70] 14: 133-196, ill. **Fernandez, A.**—Nuevas formas de lepidopteros exoticos (S). [Bol. Soc. Espana. H. N.] 32: 453-454, ill. **May, E.**—Prepona meander castorina. [Bol. Mus. Nac. R. de Jan.] 8: 64-65. (S*). **Wille, J.**—Der "Perforador de la bellota", Mescinia perucella, ein wichtiger schädling der baumwolle in Perú. (Pyralidae). [105] 4: 455-485, ill. (*).

DIPTERA.—da Costa Lima, A.—Chave para a determinação dos Flebotomos americanos. [105] 4: 427-429. **da Costa Lima, A.**—Moscas de frutas so gen. Anastrepha. [Mem. Ins. O. Cruz] 28: 487-576, ill. (S*). **Curran, H. C.**—New American Asilidae, III. [40] 752: 18 pp. **Reinhard, H. J.**—Revision of the American two-winged flies belonging to the genus Cuphocera. [50] 83: 45-70. (*). **Scott, H.**—The puparium of Nycteribia (Listropodia) pedicularia with general remarks on this stage in Nycteribiidae. [8] 70: 255-259, ill. **Shaw, F. R.**—A new species of Sciara. [4] 66: 233, ill. **Townsend, C. H. T.**—Mosquitoes of the Rio Tapajós. [105] 4: 486-499.

COLEOPTERA.—Bernhauer, M.—Neue Staphyliniden aus Argentinien. [105] 4: 501-517. **Blaisdell, F. E.**—Rare North American Coleoptera. [1] 60: 317-326, ill. (*). **Borgmeier, T.**—Uma nova tribu da subfamilia Aleocharinae (Staph.). [105] 4: 451-455. **Hinton, H. E.**—Notes on Aphodius in the cadaverinus group with a description of a new species. (Scarabaeidae). [4] 66: 218-220. (cont.). **Maydell, G. G.**—New species of North American Meloidae. [1] 60: 327-336. **Nagel, P.**—Zur systematik und biologie von Sclerostomus ruficollis, nebst beschreibung der larve. (Lucanidae). [105] 4: 429-435, ill.

HYMENOPTERA.—Compere & Flanders.—Anarhopus sydneyensis, an encyrtid parasite of Pseudococcus longispinus recently introduced into California from Australia. [12] 27: 966-973, ill. **Molitor, A.**—Beiträge zur oekologie und ethologie der Hymenopteren. [Bol. Lab. di Ent. R. Ist. Sup. Agr. Bologna] 6: 151-163.

OBITUARY

The daily press announced the death of Dr. Theobald Smith, on December 10, 1934, at New York. While he was in charge of investigation of infectious animal diseases in the Bureau of Animal Industry, U. S. Department of Agriculture (1884-95), he and Kilborne showed that Texas fever was spread from infested to healthy cattle by the tick, *Margaropus* (or *Boophilus*) *annulatus*, said to be the first demonstration that arthropods transmit pathogenic organisms. He was born at Albany, New York, July 31, 1859, received the degree of Ph. B. from Cornell in 1881, and of M. D. from Albany Medical College, Union University, in 1883. While connected with the U. S. Department of Agriculture, he was also professor of bacteriology at George Washington University. From 1896 to 1915, he was professor of comparative pathology at Harvard University, and from 1916 to 1929, director of the department of animal pathology of the Rockefeller Institute at Princeton, New Jersey. He was the recipient of many honorary degrees from universities in the United States and Europe, and member or fellow of such bodies as the Royal Society of London, and the Academies of Science of Paris, Denmark and the United States.

The number of Entomological News for December, 1934, was mailed at the Philadelphia Post Office on December 20, 1934.

EXCHANGES

This column is intended only for wants and exchanges, not for advertisements of goods for sale or services rendered. Notices not exceeding three lines free to subscribers.

These notices are continued as long as our limited space will allow; the new ones are added at the end of the column, and, only when necessary those at the top (being longest in) are discontinued.

Exchange—Pachysphinx modesta. Progeny of modesta imperator (female) and normal male to exchange for Erinnys or other southern Sphingids. Heodes dorcas and others offered for Florida Theclas or Hesperiidae. Perfect specimens only. H. M. Bower, 1302 Davis Street, Evanston, Illinois.

Exchange—Will collect insects of Connecticut this season and desire to get in touch with collectors desiring this material, either in exchange or for cash. Harry L. Johnson, So. Meriden, Conn.

Wanted—Names and addresses of those desiring Cocoons of Actias luna and Automeris io. Exchange considered. Eggs in season. Virginia Weaver, 822 S. College Ave., Tulsa, Okla.

Literature Wanted—Barnes & McDunnough's "Contributions," Henry Edward's "Pacific Coast Lepidoptera" and other publications relative to North American Lepidoptera. C. F. dos Passos, Mendham, New Jersey.

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COLEOPTERA

989.—**Blaisdell** (F. E.).—Studies in the genus Auchmobius. Tenebrionidae. (Trans., **60**, 223-264, 3 pls., 1934).... .80

DIPTERA

987.—**Huckett** (H. C.).—A revision of the North American species belonging to the genus Coenosia (Muscidae). II. The subgenus Limosia. (Trans., **60**, 133-198, 6 pls., 1934) 1.25

988.—**Cresson** (E. T.).—Descriptions of new genera and species of the dipterous family Ephydridae. XI. (Trans., **60**, 199-222, 1934) ..... .50

LEPIDOPTERA

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ORTHOPTERA

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